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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,567	10/31/2003	Thomas James Gallagher	VAL 176 P2	1129
34232	7590	12/14/2005	EXAMINER	
MATTHEW R. JENKINS, ESQ. 2310 FAR HILLS BUILDING DAYTON, OH 45419			MILLER, PATRICK L	
			ART UNIT	PAPER NUMBER
			2837	

DATE MAILED: 12/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Ans

Office Action Summary	Application No. 10/698,567	Applicant(s) GALLAGHER ET AL.	
	Examiner Patrick Miller	Art Unit 2837	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-33 and 35 is/are rejected.
- 7) ☒ Claim(s) 34 and 36 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 October 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>05032004</u> . | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Drawings

1. The drawings are objected to because Figure 10 has “extra” wording (“Artist: Please do not re-arrange this figure. Thanks”). Please delete this wording. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: see bullet(s) below.

Appropriate correction is required.

- Multiple figures are labeled as “Prior Art.” Please label the brief description of the drawings with explicit nomenclature stating that the figures are prior art. E.g., “Figure 1 illustrates three coils, as used in a prior art three-phase motor.”

Claim Objections

3. Claims 3, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 31, and 32 are objected to because of the following informalities: see bullet(s) below. Appropriate correction is required.

- Claim 3, 8, 11, and 12 recite, “need not be simultaneous.” Either the PWM is or is not simultaneous. Please correct.
- Claims 13, 14, 17, 18, recite, “N is greater than two.” For clarification, does N need to be an integer or not? For examination purposes, the examiner interprets N to be an integer greater than two.
- The preamble of claim 13 does not begin with “[a] method for controlling...”
- Claim 14 recites, N is greater than two.” This term is already defined in claim 13.
- Claims 23 and 25 recites, “the only coordinate transformations undertaken are...” Is this supposed to mean that the only coordinate transformations undertaken by the control system? Please clarify. For examination purposes, the examiner has interpreted the claim language to mean that the control system only transforms coordinates by the two transformations listed.

Art Unit: 2837

- Claim 31 recites, “N lines of code.” “N” is not defined. E.g., where N is an integer greater than zero.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 27, 28, 31, and 32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
 - Claim 27 recites, “obtaining an expression for orthogonal components of the stator field, without computing said components” (emphasis added). It is unclear how the expressions are obtained without computing the components. Furthermore, claim 28 states that the method computes “coordinates of the orthogonal components in a rotating coordinate system.”
 - The examiner does not understand claim 31 as worded. The examiner understands the basic concept (a control program for a two-phase motor has fewer lines of code than would a control program for a three-phase motor); however, the way (b)(ii) is worded makes the claim difficult to comprehend. Please revise.
 - Claim 32 discloses a two-phase motor. Claim 31, from which claim 32 depends, discloses a three-phase motor. It is unclear what phase motor the applicant intends to claim. Please clarify. For examination purposes, the examiner has determined that claim 31 requires a three-phase motor.

- With respect to claim 32, it is unclear how the two-phase motor is the means for converting power because the means for converting requires a way to store and operate code.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 13-17, 19, 21, 23, and 25, are rejected under 35 U.S.C. 102(e) as being anticipated by Kuwano et al. (5,294,876).

- With respect to claims 13 and 17, Kuwano et al. discloses a system with an electric motor having stator coils which produce a rotating field vector (Fig. 3, all boxes control the electric motor, and the motor is a stepping motor, which produces a rotating field vector; see also Figs. 1 and 2), and a method for controlling said system, and which is controlled by a control system implementing a field-oriented control (FOC), the method comprising: deriving data concerning behavior of the coils (Fig3, encoder output is based on the behavior of the coils); and based on the data, computing position of the stator field vector without translating from an N-phase reference frame of the stator to an orthogonal reference frame, where N is greater than two (Fig. 3, #22 does not calculate theta.sub.f using a transformation; see also col. 6, ll. 15-21).

- With respect to claims 14, 15, 16, and 19, the method further comprises: computing a demanded stator field vector in the rotating coordinate system (Fig. 3, #61 computes V_{α} and V_{β}); and computing currents required to produce the demanded stator field vector without translating into an N-phase reference frame, where N is greater than two (Fig. 3, currents i_{df} and i_{qf} are calculated based on a two-phase to two-phase transformation, which meets the limitations since N is three or greater). Note that typically, three phase systems transform from three phase ($N=3$) to two phase.
- Note that these claims recite the limitations negatively. Thus, as long as the system performs the transformation in another way where N is not greater than two, the claim limitations are met.
- With respect to claim 21, the means comprise electronic circuitry (Fig. 3).
- With respect to claims 23 and 25, Kuwano et al. discloses a system and method comprising: a motor comprising a two phase stator of the synchronous type (stepper motor is a synchronous motor); and a control system that implements a field-oriented control, wherein said control system only coordinate transforms from a stationary to a rotating system and from the rotating system to the stationary system (Fig. 3, #62 transforms from rotating to stationary and #61 transforms from stationary to rotating).

Note that the examiner has defined the system as only item #s 61 and 62.

6. Claims 27 and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Marcinkiewicz (6,326,750).
 - With respect to claims 27 and 28, Marcinkiewicz discloses a method comprising: the method is conducted in a vehicle (col. 1, l. 51) and maintains a synchronous electric

motor (col. 4, ll. 6-14; permanent magnet machine is a synchronous motor); generating currents in the motor coils to produce a rotating stator field vector (Fig. 22, #154 generates currents to the motor windings); and obtaining an expression for orthogonal components of the stator field by transforming the rotating components (Fig. 22, #228 obtains an expression because it must calculate the orthogonal components).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1, 4, 6, 9, 11, 12, 18, 20, 22, 29, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuwano et al. (5,294,876).
 - With respect to claims 1, 6, 11, and 12, Kuwano et al. discloses a system in a vehicle that is powered by an inverter (Fig. 3, #70), the system comprising: a two-phase electric motor having a synchronous stator and two stator phases (Fig. 3, #80 is a stepper motor, which is a synchronous motor); a field-oriented controller that controls voltages applied to the phases (Fig. 3, all boxes are interpreted as the controller and V_{α} and V_{β} are the output voltages); and all phases are independently controllable (switches inside the inverter 70 can be independently controlled for each phase); and pulse-width modulation (PWM) is used to control the magnitude of current in each phases, where the PWM applied to one phase is synchronized with the PWM applied to the other phase (col. 5, ll.

56-61, since the claim says need not be), and voltage is available for each phase (Fig. 3, inverter 70 supplies to each phase).

- Kuwano et al. does not explicitly disclose a battery that supplies the motor power and full battery voltage is available for application across each phase of the motor.
- With respect to these features the examiner take official notice. First, it is well known and would have been obvious to one having ordinary skill in the art at the time of the invention that the inverter of Kuwano et al. would be connected to a battery.

Specifically, the motor would receive voltage from the battery via the switching elements in the inverter. Using a battery provides the advantage of allowing the system to be portable. Second, it would have been obvious to one having ordinary skill in the art at the time of the invention that based on how the switching elements in the inverter were controlled, the full battery voltage would be available across each phase. For example, if the motor was to be operated at full speed, the inverter unit would be controlled to output maximum voltage from the battery so that the motor would operate at its highest rotational speed.

- Also note that the “vehicle” limitation in the preamble has not been given patentable weight in claim 1 because it has not been positively recited in this particular claim.
- With respect to claims 4 and 9, if the battery voltage decreased, the duty cycle of the PWM is increased so as to not reduce the maximum current generated for each motor phase (col. 1, ll. 27-30).
- With respect to claims 18 and 20, the method further comprises: computing a demanded stator field vector in the rotating coordinate system (Fig. 3, #61 computes V_{α} and

Vbeta); and computing currents required to produce the demanded stator field vector without translating into an N-phase reference frame, where N is greater than two (Fig. 3, currents i_{df} and i_{qf} are calculated based on a two-phase to two-phase transformation, which meets the limitations since N is three or greater). Note that typically, three phase systems transform from three phase (N=3) to two phase.

- Note that these claims recite the limitations negatively. Thus, as long as the system performs the transformation in another way where N is not greater than two, the claim limitations are met.
- With respect to claim 22, the means comprise electronic circuitry (Fig. 3).
- With respect to claim 29, Kuwano et al. discloses a system comprising: a power supply delivering a voltage (Fig. 29, #70); a motor having phase coils in a synchronous-type stator (stepping motor is a synchronous motor); and a system providing field oriented control to the motor (Fig. 3, the transformations based on current and position represent the field-oriented control). Additionally, the general formula for power is $P=V \cdot I$. Thus, since the system does not require the actual calculation or manipulation of the signals, this general principle is inherent to the system.
- With respect to claims 33 and 35, V_{α} and V_{β} are calculated using the voltages V_d and V_q (voltage magnitudes) and the rotor angle (θ_f).

Art Unit: 2837

8. Claims 2, 3, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuwano et al. as applied to claim 1 above.

- With respect to claims 2, 3, 7, and 8, Kuwano et al. does not explicitly disclose the PWM applied to one phase is not simultaneous to the PWM applied to the other phase. With respect to this feature, the examiner takes official notice. First, it is well known in the art and would have been obvious to one having ordinary skill in the art at the time of the invention that PWM controls the magnitude of current applied to the motor. Second, it is also well known in the art and would have been obvious to one having ordinary skill in the art at the time of the invention that the two phases could not be energized simultaneously because this would not produce sufficient torque to drive the motor. Thus, with one phase being energized at some period before the second phase, this means that they are not simultaneous.

9. Claims 5, 10, 24, 26, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuwano et al. as applied to claims 1, 6, 23, 25, and 29 above, and further in view of Furukawa (5,767,642).

- Kuwano et al. does not disclose the stepper motor being implemented in a power steering system of a vehicle.
- Furukawa discloses a stepper motor that is implemented in a power steering system of a vehicle (Fig. 1, #15). The motivation to use a power steering system with the Kuwano et al. stepper motor and stepper motor control system is because of the high resolution, which allows for precise control of the power steering system. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to

implement the vehicle power steering system into the Kuwano et al. system, as taught by Furukawa.

10. Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (5,159,542).

- With respect to claims 31 and 32, Miller et al. discloses a system in a vehicle (col. 1, ll. 44-46; vehicle suspension) comprising: a power source/power receiving pair (Fig. 1, #124 and #112); an electrical power source in the vehicle (Fig. 1, #124); a mechanical device to be powered (col. 1, ll. 44-46; vehicle suspension); a controller that implements field-oriented control (Fig. 1, #110); and a means for converting power from the source to the receiver (Fig. 1, either #112 converts power from #124 to #102 or #102 converts electrical power to mechanical power to drive the suspension).
- Miller et al. does not disclose a DSP that implements a field oriented control and a computer program having N lines of code for a three-phase motor application .75N lines of code for a two-phase motor application. The examiner takes Official Notice with respect to this feature. It is well known and would have been obvious to one having ordinary skill in the art at the time of the invention that the circuitry disclosed by Miller et al. would be more efficiently implemented using a DSP and a computer having code. The motivation to use a DSP and a computer with code is because a DSP is faster than the same analog circuitry and a computer is advantageous because the code may be reprogrammed. Furthermore, it would have been obvious to one having ordinary skill in the art at the time of the invention that the amount of code for a three phase motor would be significantly greater than would the amount of code for controlling a two-phase motor.

For instance, a programmer would not have to take into account the additional code required to receive a third motor current signal, the output signals for the third phase of the motor, and the more complex transformations that must be done when transforming from two phase to three phase and vice versa. It would have been obvious to one having ordinary skill in the art that a reduction by 25% would be a reasonable estimate of the amount of code that would not have to be written for a two phase system.

Allowable Subject Matter

11. Claims 34 and 36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

- With respect to claims 34 and 36, the Prior Art does not disclose calculating a duty cycle as disclosed, with the limitations of claims 1 and 33.

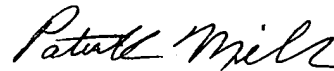
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick Miller whose telephone number is 571-272-2070. The examiner can normally be reached on M-F, 8:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Martin can be reached on 571-272-2800 ext 41. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9318.

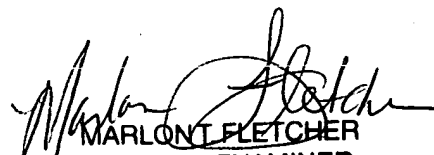
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Patrick Miller
Examiner
Art Unit 2837

pm
June 2, 2005



MARLON FLETCHER
PRIMARY EXAMINER